DEFENSE NUCLEAR FACILITIES SAFETY BOARD

625 Indiana Avenue, NW, Suite 700, Washington, D.C. 20004
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May 5, 1995

The Honorable Victor H. Reis
Assistant Secretary for Defense Programs
Department of Energy
Washington, D.C. 20585

Dear Dr. Reis:

On November 25, 1994, the Defense Nuclear Facilities Safety Board (Board) requested a report identifying the formal process(es) the Los Alamos National Laboratory (LANL) is following to identify and mitigate hazards in the design, construction, and preparation for operation of new and upgraded defense nuclear facilities. In your initial reply of March 6, 1995, you stated that the Chemistry and Metallurgy Research (CMR) building upgrades project will serve as an example for defense nuclear projects at LANL.

The Board's staff has recently visited the CMR building, as well as the TA-55 Plutonium Facility, to review electrical, instrumentation and control systems, and configuration management. The staff has provided the Board with the two enclosed reports. Based on these reports, it is likely that a proper identification of hazards for the apparent mission of CMR would lead to the necessity of providing emergency/standby power. LANL stated that while emergency/standby power will be considered for the upgrades, it is possible that neither emergency nor standby power will be implemented. In addition, it appears that configuration management activities need to be considerably strengthened prior to significant additional physical work on the CMR upgrades.

The Board believes these observations merit Department of Energy line management attention. Hence, the enclosed staff trip reports are forwarded for your information and use. Mr. Steven Krahn of the Board's staff will be available to provide any additional information you may require.

Sincerely,

John T. Conway
Chairman

c: Mr. Mark Whitaker

Enclosures

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

February 22, 1995

MEMORANDUM FOR: G. W. Cunningham, Technical Director

COPIES: Board Members

FROM: Ajit K. Gwal

SUBJECT: Los Alamos National Laboratory - Chemistry and Metallurgy Research and Technical Area 55 - Trip Report (January 23-26, 1995)

1. **Purpose:** This report documents a review of the electrical, instrumentation, and control systems at the Los Alamos National Laboratory (LANL) Chemistry and Metallurgy Research (CMR) building and the Technical Area 55 (TA-55) facility by Defense Nuclear Facilities Safety Board (DNFSB) technical staff, Ajit K. Gwal and R. Todd Davis on January 23-26, 1995.

2. **Summary:**

   a. CMR Building:

      1. Maintenance: A comprehensive program for corrective, preventive, and predictive maintenance does not exist for electrical equipment at the CMR building. Facility electrical maintenance is performed approximately every three years by a site-wide LANL organization, regardless of equipment requirements in accordance with industry standards and vendor recommendations.

      2. Emergency/Standby Power: The facility ventilation system (that maintains directional air flow to prevent spread of contamination), fire alarm system, and most radiological monitors are not supplied with emergency or standby power. Reliable power is an essential element of the power distribution system for defense nuclear facilities to ensure safe facility shutdown, limit the spread of contamination, and detect fire and radiological hazards.

      3. Battery Ventilation: Lead-acid battery ventilation in both the CMR building and the TA-55 facility is inadequate. Ventilation is necessary to prevent hazardous buildup of hydrogen gas. There is currently no plan to upgrade the battery ventilation systems. Good industry practices with respect to battery room ventilation are the requirements of American National Standards Institute (ANSI) C2, *National Electric Safety Code*.

b. TA-55 Facility:

1. Oil-Insulated Transformer: Four oil-insulated transformers, that are part of the power distribution system, are located inside the TA-55 facility. The transformer oil, that provides transformer cooling, is flammable and is a fire hazard if the transformer leaks or fails catastrophically.

2. Electrical Calculations: Electrical calculations required by industry standards for voltage profile, short circuit studies, and protective device coordination were not available. These calculations are necessary in the evaluation of the electrical distribution system's safety and reliability.

3. Emergency Power: The facility currently has only one standby Diesel Generator (DG). There is an ongoing staff review to determine if the facility requires emergency backup power and, therefore, requires an additional diesel generator.

3. Background: The CMR building was constructed in the early 1950s and provides experimental facilities for plutonium and uranium chemistry and metallurgy research. The TA-55 plutonium processing and handling facility, that was constructed in the mid 1970s, provides capabilities for recycling, preparation, fabrication and research of plutonium and analytical chemistry.

4. Discussion:

a. The review identified the following potentially significant issues at the CMR building:

1. Maintenance: Electrical maintenance at the CMR building is performed by a site-wide organization approximately every three years. However, many electrical components (e.g., batteries, relays and breakers) require more frequent maintenance. CMR personnel are preparing a Master Equipment List (MEL) in accordance with Department of Energy (DOE) Order 4330.4B, *Maintenance Management Program,* that will identify safety and non-safety related equipment. As discussed in the CMR building Maintenance Implementation Plan, the MEL will eventually be used for maintenance planning and scheduling.

2. Emergency/Standby Power: The facility ventilation system (that maintains directional air flow to prevent spread of contamination), fire alarm system, and most radiological monitors are not supplied with emergency or standby power and become inoperable during a loss of power. DOE Order 6430.1A requires emergency or standby power for " . . . equipment components whose operating continuity is determined to be vital . . . for protection of health, life, property, and safeguards and security systems. . . [including] fire alarm, security alarm, and supervisory sensing devices designated essential by the cognizant DOE authority." Based on the safety-related function of the systems identified

above, the staff believes a reliable backup power source is appropriate for the CMR building. Additional analysis is required to determine whether the backup power supply should be emergency or standby. CMR personnel stated that installation of backup generators will be considered during the second phase of upgrades scheduled to begin in 1996.

3. Battery Ventilation: ANSI C2 *National Electric Safety Code* requires adequate ventilation and loss of ventilation alarms for rooms with lead-acid batteries to ensure hydrogen does not buildup and result in an explosion. The battery systems at both the CMR building and the TA-55 facility do not meet the requirements of ANSI C2 (i.e., inadequate ventilation and no loss of ventilation alarms).

4. Electrical Upgrade: Because the CMR building was constructed in the early 1950s and is reaching the end of its design life, significant upgrades are required to allow the building to continue its mission. An interim safety analysis report was written in 1992 that identifies the facility weaknesses and formed the basis for a 10-year upgrade project. The project is divided into three phases with the first through third phases scheduled to be complete in 1996, 2002, and 2003, respectively. Most of the electrical upgrades, that are budgeted for approximately 20 million dollars, are scheduled for accomplishment during the first phase of upgrades. The electrical upgrades include replacement of three substations, correcting deficiencies, installing an Uninterruptible Power Supply (UPS) for the stack monitors and upgrading the emergency lighting, low voltage power distribution, grounding and lightning systems.

5. Facility Electrical Support: Except for personnel associated with the current electrical upgrades, the CMR building does not have an electrical systems engineer as part of the dedicated staff. Considering the size and type of facility, the staff believes facility staffing should include an electrical systems engineer.

6. Single Point Failure: The LANL electrical distribution system can receive power from two separate power generation plants. However, the high voltage transmission lines that provide power to the site cross each other at one point. A failure of the transmission lines at this point could isolate the site from power for an extended period.

b. The review identified the following potentially significant issues at the TA-55 facility:

1. Oil-Insulated Transformer: Four oil-insulated transformers located inside the plutonium handling facility are part of the power distribution system. The transformer oil provides cooling for the transformer. Because the oil is flammable, it is a fire hazard if the transformer leaks or fails catastrophically. DOE Order 6430.1A states that "only hazardous gases or liquids that are necessary for a process shall be used in plutonium processing and handling facilities." In addition, the *National Electrical Safety Code* and

National Fire Protection Association (NFPA) 70, *National Electric Code*, require indoor oil-insulated transformers be located in a transformer vault. The code requirements for the transformer vault include fire walls and doors, ventilation, and oil containment and drainage. The TA-55 transformers do not meet the requirements for oil containment. Additional justification and/or mitigation of the oil hazard may be appropriate to ensure safe operation of the TA-55 facility. DNFSB staff believes that the replacement of oil-insulted transformer with a dry type transformer is a prudent approach to resolve this concern.

2. Electrical Calculations: Electrical calculations for voltage profile, short circuit studies and protective device coordination, as required by the ANSI/Institute of Electrical and Electronics Engineers (IEEE) standard 141, *IEEE Recommended Practice for Electrical Power Distribution for Industrial Plants*, and ANSI/IEEE standard 242, *IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems*, were not available. Therefore, the staff could not verify the capability of electrical equipment to withstand available short circuit currents without creating unsafe conditions for site workers.

3. Emergency Power: The TA-55 facility currently has only one Diesel Generator. In addition, this generator does not start automatically after failure of the normal source of power. TA-55 personnel stated that a review of DG design has been performed and that final determination of DG classification and functional requirements will be addressed in the Final Safety Analysis Report (scheduled to be submitted to DOE in July 1995). There is an ongoing staff review to determine if the facility requires emergency backup power and, therefore, requires an additional diesel generator and design upgrades.

4. Utility Control System Upgrade: The TA-55 utility control system, which monitors and partially controls the power distribution, ventilation, and radiological monitoring systems, is over 15 years old and fails frequently. The facility is upgrading the system with programmable logic controllers that will provide reliable utility monitoring and control capabilities. This project is scheduled to be completed in 1996.

5. **Future Staff Actions:** The DNFSB staff plans to continue to follow the upgrade project for the CMR building including resolution of maintenance, backup power, and battery ventilation issues identified in this report. In addition, the staff plans to follow-up on the TA-55 facility resolution of staff observations relative to the backup DG, oil-insulated transformers, the electrical distribution system calculations and the utility control system upgrade.

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

February 9, 1995

MEMORANDUM FOR: G.W. Cunningham Technical Director

COPIES: Board Members

FROM: Donald J. Wille

SUBJECT: Los Alamos National Laboratory - Configuration Management at Chemistry and Metallurgy Research Building and Technical Area 55 (January 24-26, 1995)

1. **Purpose:** This report documents a review of configuration management activities at the Los Alamos National Laboratory (LANL) Chemistry and Metallurgy Research (CMR) building and the Technical Area 55 (TA-55) Plutonium Facility (PF-4) by Defense Nuclear Facilities Safety Board (Board) technical staff, Donald J. Wille and Roger W. Zavadoski on January 24-26, 1995.

2. **Summary:** Configuration management at LANL is only a few years old and a significant learning process is still underway. Facility managers define the practices and procedures for their own facilities. At the CMR facility, the change control procedure applies only to the current Phase 1 electrical upgrade activities. There is a need to considerably strengthen the configuration management program prior to Phase 2 upgrade activities. At TA-55 twenty design change packages are in progress under the configuration management control procedure and only one package has been completed.

   The design bases for the ventilation systems at CMR and TA-55 are not in compliance with the Department of Energy (DOE) Order 6430.1A, *General Design Criteria* in that, neither facility has a commitment to provide an ongoing comparison of the design against requirements.

3. **Background:**

   a. Configuration Management at CMR- The CMR facility Configuration Management Plan was issued in December 1994 and the policy issued in January 1995 (contained in the Quality Management Plan). The CMR change control procedure was issued in December 1994 based on the change control procedure developed for TA-55 and applied to the Phase 1 electrical system upgrades currently in progress.

b. Configuration Management at TA-55- TA-55 issued a Configuration Management Plan dated January 20, 1995, that defined a program consistent with the guidelines in the DOE standard, *Guide for Operational Configuration Management Program,* DOE-STD-1073-93. This plan includes an operational program and an adjunct design basis reconstitution activity.

c. Compliance with DOE Order 6430.1A- The draft Safety Analysis Report (SAR) for CMR issued in 1994 contained an Appendix 3 listing the comparison of the facility design with the requirements of DOE Order 6430.1A. The final SAR is in preparation, and LANL indicated that it does not contain such a comparison.

4. Discussion:

a. CMR - Configuration Management - The configuration management (CM) process at CMR is a very new activity and does not have a dedicated individual. The CM function is provided by the Facility Manager, or designee, on a part-time basis. The Facility Management group does have sensitivity to the ownership of the facility and knowledge of the daily ongoing activities within the building. However, this is often on an informal basis, which could lead to surprises.

b. CMR - Change Control - The recently issued change control procedure only applies to the current Phase 1 upgrades and does not apply to temporary changes (variances) or changes to procedures. This results in a slow learning process and may not include necessary work items, such as maintenance, for some time. Configuration management activities need to be considerably strengthened prior to Phase 2 upgrade activities.

c. TA-55 - CM Program - The recently issued configuration management program plan recognizes that not all elements of the final program can be implemented at the outset and compensating measures will be taken in the interim. For example, tracking of proposed changes against drawings will be done using a retrievable index until a Master Document List and controlling software are developed.

d. TA-55 - System Classification - Classification of the facility structures, systems, and components (SSC) will be in four SSC grades based on the TA-55 SAR upgrade project. These are (1) Safety class (SC); (2) Safety-significant (SS); (3) Mission-critical (MC); and (4) Balance-of-plant (BOP). Currently only four systems are included in the two safety grades. They are (1) Confinement System - (SC) (includes portions of the ventilation systems); (2) Zone 1, 2, and 3 Ventilation Systems - (SS) (sections not included above); (3) Critical Alarm System - (SS); and (4) Continuous Air Monitors - (SS).

The ongoing SAR upgrade project analysis may result in additional systems being added to the safety grades. It is important to note that many support systems that may be needed for proper functioning of safety grade systems are not included, such as Uninterruptible Power Supply (UPS) and the Diesel Generator. This will require further review as part of the Safety and Hazards Analysis and Electrical Systems elements.

e. TA-55 - Design - System Design Descriptions (SDD) are being prepared to capture the system features and design requirements. This procedure only requires SDDs to be prepared for the four safety grade systems, although a total of 12 SDDs are being prepared at the present time. The as-built drawing program in progress is expected to have about 300 drawings transferred to a Computer Aided Design (CAD) system. Approximately 15,000 drawings exist for the original facility.

f. TA-55 - Change Control - A new procedure for Change Control for Systems, Structures, and Components was issued on June 17, 1994. There are 20 Design Change Packages (DCPs) initiated under this procedure with 17 DCPs currently in development. Of the remaining three DCPs, one is approved for construction, one is installed and approved for operation, and one DCP is completed and closed. This procedure provides for a comprehensive review and documentation of proposed design changes and physical item changes. The level of review and analysis for a DCP depends on the nature of the proposed change and always includes a safety screen review.

g. Ventilation Systems Design at CMR and TA-55 - The ventilation systems at CMR and TA-55 are not in accordance with certain requirements of DOE Order 6430.1A, *General Design Criteria,* for redundancy, emergency power supply, and mitigation of off-site dose following postulated accidents. Compliance with the requirements of DOE Order 6430.1A will not be identified in the updated SARs. It is noted that DOE Order 5480.23 section 8.b.(3).(b) requires that a SAR address applicable statutes, rules, regulations, and DOE Orders, and provide sufficient detail to serve as a comprehensive reference, and explicitly demonstrate compliance with these applicable statutes, rules, and Orders.

5. **Future Staff Actions:** The Board's staff plans to review the following:

a. Review some completed DCPs for technical adequacy and compliance with procedures.

b. Review development of completed SDDs and the basis for design requirements.

c. Review the final SAR for CMR and the SAR Upgrade for TA-55 for compliance with DOE Order 5480.23 to address applicable statutes, rules, regulations, and DOE Orders; particularly, DOE Order 64301.A.